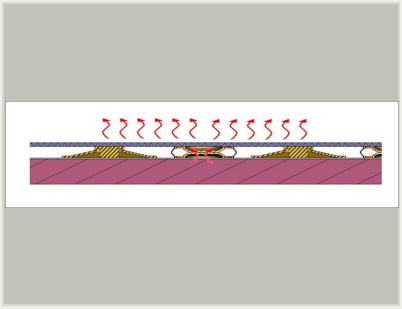
Variable Conductance Radiator: A Novel Lightweight, High Turndown Spacecraft Radiator Using Variable Heat Conductors, Phase I

Completed Technology Project (2017 - 2017)

Project Introduction

Spacecraft thermal control is a critical element to maintaining spacecraft, manned, unmanned or robotic, at proper temperatures for humans, instruments and electronics to function properly. Simple, passive thermal control in which excess heat is radiated to space via blackbody radiators used to be adequate, however, as spacecraft power levels increase and mission environments become more complex, more flexible and capable thermal control systems and mechanisms are needed. Variable heat rejection is an enabling technology to reliably vary heat rejection during human and robotic spaceflight missions with wide variation in thermal environments & vehicle heat loads. Quest Thermal Group is proposing a novel Variable Conductor Radiator (VCR) that uses actuated heat conductors within an IMLI structure to control heat conduction. A VCR could provide both high and very low heat rejection, operating as both effective radiators and high performance insulation, and capable of turndown ratios of 80:1. The NASA 2012 TA14 Thermal Management Roadmap stated radiator advancement is perhaps the most critical thermal technology development for future spacecraft and space-based systems. NASA is seeking unique solutions for thermal control technology providing low mass highly reliable thermal control systems. As NASA moves beyond LEO, spacecraft must accommodate various mission scenarios and need variable heat rejection. Current state of the art variable radiators offer heat rejection turn-down ratios up to about 4:1. Phase I goals are to develop a new variable spacecraft radiator that can simply and efficiently provide a highly variable heat rejection using variable solid conduction within IMLI insulation, and prove feasibility of the VCR concept to help improve radiator capabilities for future NASA and commercial spacecraft. A VCR prototype will be modeled, designed, built and tested for thermal performance and variable heat rejection.



Variable Conductance Radiator: A Novel Lightweight, High Turndown Spacecraft Radiator Using Variable Heat Conductors, Phase I Briefing Chart Image

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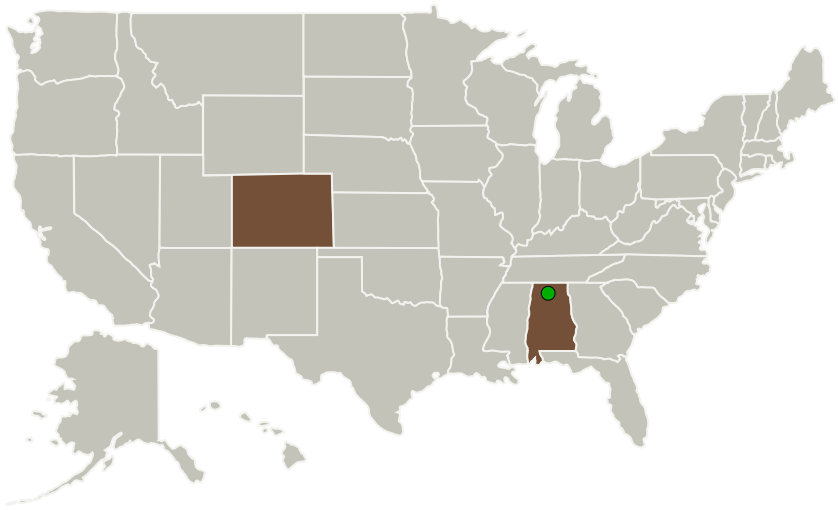


Organizations Performing Work	Role	Type	Location
Quest Thermal Group	Lead Organization	Industry	Arvada, Colorado
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Colorado

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Quest Thermal Group

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

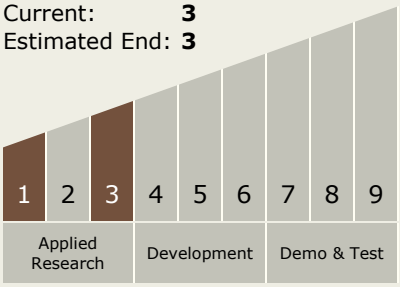
Carlos Torrez

Principal Investigator:

Scott A Dye

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



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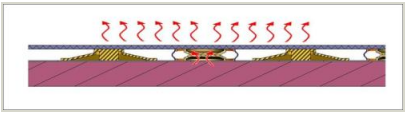
Images



Briefing Chart Image
Variable Conductance Radiator: A Novel Lightweight, High Turndown Spacecraft Radiator Using Variable Heat Conductors, Phase I Briefing Chart Image
(https://techport.nasa.gov/image/126232)

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.2 Thermal Control Components and Systems
    - TX14.2.3 Heat Rejection and Storage

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System